have approximately the same mean annual temperature everywhere, and that in abrupt ascent there is a decrease in mean annual temperature, of about 1° F. for every 300 feet, Mr. Gannett thought to determine the temperature at the timber line, from that of a station at or near the base (supposed, though not always correctly, to represent the average climate round the base), together with the height. The tabulated figures, for thirteen mountains, &c., yield the mean 30°·4, which is probably very near the true mean annual temperature of the timber line. Should the result hold good, after wider observation, it will afford, Mr. Gannett says, a very valuable and easily obtainable isothermal, and also enable one to estimate the height of the timber line from thermometric stations at the bases of mountain ranges.

ON April 26 M. Broch, president, and the delegates of the Bureau International des Poids et Mesures, presented to M. Tirard, the Minister of Commerce, specimens of the facsimile reproductions of the standard metres and kilogrammes preserved since the beginning of the century in the French National Archives. These copies have been executed with an alloy of platinum and iridium, in compliance with the instructions given by MM. Henry Sainte Clair-Deville and Debray. This great work has taken not less than ten years. These facsimiles have been sent to the Bureau at Breteuil, where they will be used in executing the copies ordered by the several nations for their use.

A NEW edition of Kelland and Tait's "Introduction to Quaternions" has been published by Macmillan and Co. While refraining from making any changes in the late Prof. Kelland's part of the work, Prof. Tait has re-cast his own where he fancied he could improve it.

THE Committee of the Sunday Society are more than usually active just now in connection with the motion for extending the opening of museums on Sundays, which Mr. George Howard is to propose in the House of Commons on the 19th inst. On the 17th inst. a National Conference of Delegates from Provincial Towns, Trade Societies, and other organisations, is to be held at the Westminster Palace Hotel under the presidency of Viscount Powerscourt, and in the evening of the same day a large meeting is to take place at St. James's Hall, when addresses are to be delivered by Lord Powerscroft, Lord Dunraven, Lord Dorchester, Mr. Thomas Burt, M.P., Mr. George Howard, M.P., Dr. Richardson, and others.

THE additions to the Zoological Society's Gardens during the past week include Six Northern Marsh Tits (*Parus borealis*) from Russia, presented by Mr. A. H. Jamrach; four Pigmy Pigs (*Porcula salviana* ♂ ♀ ♀ ♀) from Nepaul, a Burmese Tortoise (*Testudo elongata*), a —— Terrapin (*Clemmys*, sp. inc.) from Burmah, received on approval; two Green Monkeys (*Cercopithecus callitrichus*) from West Africa, a Grey-headed Love Bird (*Agapornis cana*) from Madagascar, received in exchange; a Water Chevrotain (*Hyomoschus aquaticus*), a Golden-haired Tiger Cat (*Felis chrysothrix*) from West Africa, a Mercenary Amazon (*Chrysotis mercenaria*) from Columbia, three Chiloe Wigeon (*Mareca chiloensis* ♂ ♀ ♀) from Chili, a Silky Bower Bird (*Ptilonorhynchus violaceus*), two Blue-faced Honey-Eaters (*Entomyza cyanotis*) from Australia, a Red-handed Tamarin (*Midas rufimanus*) from Brazil, a Wild Duck (*Anas boscas* ♀), British, four Yellow-billed Cardinals (*Paroaria capitata* ♂ ♂ ♀ ♀) from South America, purchased.

OUR ASTRONOMICAL COLUMN

ANTHELM'S NOVA OF 1670.—The vicinity of this object will soon be in a favourable position for observation, and we may once more direct attention to the small star which occupies very nearly the place given by the observations of Hevelius and Picard in 1670. By a recent careful reduction of Picard's observations, the mean place of the object for the beginning of 1670 was found to be in R.A. 19h. 34m. 5s.·3, Decl. + 26° 31′ 42″, which, accurately brought up to 1880, give, R.A. 19h. 42m. 41s.·3, Decl. + 27° 0′ 56″. Near this point we find a telescopic star, which is No. 1814 of the Greenwich catalogue of 1872, the place there assigned differing from that reduced to the year from Picard's observations by + 3s..8 in R.A., and 33″ in declination, and the right ascension for 1670 is open to an error of quite two seconds, and in greater uncertainty than the declination. The small star is followed by one (*b*) 12s.·6, about 4″·9 N., and a second (*c*) at 22s.·4, about 2″·0 N. Its magnitude has been noted as follows:—1852, April 24, 10·11 m.; 1861, May 24, 12 m.; 1872, August 23, = *b*; 1874, November 13, 0·5 m. less than *b*, decidedly less at first view. Another star (*d*) follows the one nearly in the position of *Nova*, 32s.·6, and is N. 1′.7. Prof. Schönfeld found from the observations of Hevelius and Picard combined, a place differing from that given above by − 2s.·8 in R.A., and + 0′·3 in declination.

VARIABLE STARS.—It is known that U Cephei had long been indicated as a probable variable star by the discordant magnitudes given by Schwerd's estimates 1827-28, as arranged by Oeltzen, and when taken in hand for regular examination, its short period was soon detected by Ceraski. Schwerd's estimates were from 6·7 to 10m. It appears by no means improbable that if several other stars for which the magnitudes in the various catalogues are very discordant, were systematically examined, similar cases might be found. For instance, we have 17 *ι* Andromedæ noted from 3½ to 7m., 16 Leonis Minoris 5 to 8m., 41 *ι* Aquilæ 3½ to 6m., and 35 Camelopardi 5½ to 8m.; the last, a double star, has already been found to be variable, as regards one component at least; but we have no approximation to the period.

THE COMET 1882 *a*.—The following places are derived from the same elements that were employed last week, and are for Greenwich midnight:—

1882.	R.A. h. m.	Decl. ° ′	Log. distance from Earth.	Log. distance from Sun.
May 13 ...	0 41·0 ...	+74 5		
14 ...	1 4·7 ...	73 33 ...	9·9571 ...	9·9715
15 ...	1 26·9 ...	72 51		
16 ...	1 47·5 ...	72 0 ...	9·9539 ...	9·9481
17 ...	2 6·3 ...	71 1		
18 ...	2 23·4 ...	69 54 ...	9·9518 ...	9·9227
19 ...	2 38·7 ...	68 40		
20 ...	2 52·5 ...	+67 23 ...	9·9508 ...	9·8949

Next week we may probably be in possession of elements which will allow of a close prediction of the comet's track as it approaches the sun. All the later orbits assign for the date of perihelion passage June 10.

BIOLOGICAL NOTES

FAUNA OF THE SUEZ CANAL.—Dr. C. Keller, who is engaged upon a zoological investigation of the Suez Canal, with a special view to determining what exchange of animals may have taken place between the Red Sea and the Mediterranean, has recently sent his first report from Ismailia to the St. Gall Society for Commercial Geography. He states that the exchange is proceeding slowly, owing no doubt to the presence of the lakes of bitter-water through which the canal was traced. The inhabitants of these very lakes seem to have been the first to commence migrations. This fact Dr. Keller has unquestionably ascertained with regard to several species of the lower animals; a particularly interesting case being that of a violet species of sponges, belonging to the fauna of the bitter lakes. This is now migrating in the canal towards the Mediterranean. He named this form *Lessepsia violacea*. Several larger species of fishes, which are now caught in plentiful quantities in the Timsah lake, have migrated there from the Mediterranean; amongst these are *Anarrhichas lupus*, *Solea vulgaris*, and *Pelyprion cernium*. Other species have migrated from the Red Sea to the Timsah lake, perhaps to Port Said; amongst these Dr. Keller mentions a large dark green mackerel and several brightly coloured but small Acanthopteri. The canal itself, in the direction from the Timsah lake towards Port Said shows but a poor fauna; that of the bitter lakes is also poor with regard to different species, while the representatives of the few species that are there are excessively abundant.

THE COMPARATIVE ACTION OF ISOMERIC AND METAMERIC COMPOUNDS ON THE GROWTH OF PLANTS.—In an interesting paper on this subject, lately laid before the Royal Irish Academy by Prof. Emerson Reynolds, F.R.S., he calls attention to an apparently neglected subject, and he shows that well-marked differences in physiological activity can be detected with the aid of plants, even in cases of metameric bodies of comparatively simple constitution. The bodies he selected for experiment were ammonium sulphocyanate and its metamer, theocarbamide or sulpho-urea. Both compounds are rich in nitrogen, and therefore capable of supplying a highly important element of plant food; they are easily soluble in water. The experiments were made in the summer of 1881 on plants of *Nicotiana longiflora*. They lasted over three months—August to end of November; a certain number of the plants were watered with rain-water—a certain number with the compounds in solution, otherwise all the plants were exposed to the like conditions. The following were among the chief results:—

	Water-rain.	Theocarbamide.	Sulphocyanate.
Total height in inches ...	31	23	12
Number of leaves	15	14	13
Maximum length of leaves in inches	9·5	15·25	8
Maximum breadth ditto ...	4·25	6	2·5
Number of seed pods ...	9	15	0
Ditto well developed ...	1	11	0

It would then seem (1) that the particular elements of which a body is composed exert less influence on the physiological activity of the compound than the intra-molecular grouping of the component atoms; (2) that in some instances at least differences of physiological activity between metameric bodies can be easily detected by the aid of plants.

CAUCASIAN MILK FERMENT.—The inhabitants of the high-lying lands in the Caucasus prepare, by fermentation of cows' milk, a drink which they call kephir. Kephir is used by the inhabitants of the mountains not only as an article of food, but also as a remedy against different diseases. As a ferment in the preparation of this drink, strange white lumps are used, which have a spherical or elliptical shape, and attain the size of from 1 m. to 5 cm. On a microscopical examination of these lumps, they showed that they consisted of two different substances—yeast cells and bacteria. The yeast cells may be regarded as the ordinary form, produced by cultivation, of *Saccharomyces cerevisiæ*, but Kern was unable to get these to the spore-bearing stage. As to the bacteria, they composed the chief part of the little lumps, and were in the Zoogloea state. The vegetative bacteria cells were 3·2 m. to 8m. in length, and ·8 broad. In preparations put up by drying, a distinct cell membrane could be distinguished. Treated after Koch's method, the vegetative cells show at one end a locomotive organ, which resembles a cat-and-nine-tails, of threads. When exposed to the action of acids or a high temperature, the vegetative cells grow out [probably through progressive cell-divisions] into long Leptothrix threads, which change generally precedes the spore-formation stage. The spores are round, always formed in twos in each vegetable cell, and are always placed standing on their ends; even by making use of Hartnack's immersion X, no partition wall could be discovered between the spores. In the Leptothrix-threads rows of spores could be observed, which are, however, always so situated that two spores belong to each cell. The spores while still in the cells are ·8 m. in size; those lying free attain the size of 1 m.; the germinating spores swell up 1·6 m. The germination of the spores generally takes place in such a manner that an exosporium and an endosporium can always be distinguished in them. The thinner endosporium arises out of the thicker exosporium, first as a small excrescence, which gradually increases, developing more and more into a long cylindrical tube, and then begins by cell-division to form vegetative cells. The whole course of the development to the spore-formation, beginning with the vegetative cell to the formation of a similar new cell, was followed. This newly described form of Bacteria, which undoubtedly belongs to the Desmobacteria of Cohn, is in its vegetative state not unlike the *Bacillus subtilis* of Cohn; it is, however, clearly distinguished not only from it, but also from all other kinds of Bacteria hitherto described by its spore-formation, since it always forms in each cell two round spores placed end to end, while in the species of Bacteria hitherto described, only one spore has been noticed in each cell. On account of this sharply-marked feature Kern places this form of Bacteria in a new genus, next to the genus Bacillus, and calls it *Dispora caucasica*, nov. g. et nov. sp. A more exhaustive essay on this subject, with explanatory plates, Kern promises in the next number of the *Bulletin de la Société Impérial des Naturalistes de Moscow*.—Prof. Dr. J. N. Goroschankin assisted Kern by kindly furnishing him with the necessary materials for his work, for which Kern expresses his deepest thanks.—*Botanische Zeitung*, April 21, 1882, p. 264.

NEW FRESHWATER SPONGES.—Mr. Edward Potts describes three more curious freshwater sponges in the *Proceedings* of the Academy of Natural Sciences of Philadelphia (January 10, 1882, p. 12). One found in September, 1881, near Chadd's Ford, is of a very delicate structure; its framework of skeleton spicules is exceedingly meagre, and slightly bound together, scarcely amounting to a mesh system, and the numerous small white statospheres are found in recesses far larger than themselves. This sponge has been called *Meyenia crateriforma*. Another, forming beautiful green masses, often four to five inches in diameter, and about a quarter of an inch in thickness, was found in Cobb's Creek, near Philadelphia. The surface is irregular, occasionally rising into rounded lobes; the efferent canals are deeply channeled in the upper surface of the sponge, five or six sometimes converging to a common orifice. The statospheres are numerous—rather small. There are two series of birotulate spicules, and it has been called *Heteromeyenia ryderii*. The third species was found at Lehigh Gap, Pa., in November, 1881, and belongs to the genus Tubella. This genus, established by Carter, contained only four species, all from the Amazon River. The new species is small, encrusting, and has been called *P. pennsylvanica*. The skeleton spicules are arranged in a simple series of single non-fasciculated spicules, in the interspaces of which the statospheres are abundant. These spicules are very variable in size and shape, but all are entirely and coarsely spined. The dermal spicules seem absent.

MOLLUSCOUS FAUNA OF MOSCOW.—The molluscous fauna of the neighbourhood of Moscow was very little known until now, the two former works dealing with this subject, by M. Ratchinsky and M. Madéjine, giving only fifty-one species of Gasteropods, that is, only a half of this class of Molluscs which are to be found in the neighbourhood of Moscow. M. Milachevitch fills up this gap (*Bull. de la Soc. des Naturalistes de Moscou*, No. 2) by giving a list of the Molluscs of this region, his determinations of species having been made with the help of, or revised by M. Clessin and Dr. Böttger. It is worthy of notice that of the 109 species described, 11 belong to the region of the Alps, and 17 to the boreal region, 7 of them being common to both regions, and all the Alpine species having been widely spread in Germany during the Quaternary period. A remarkable feature of the Moscow molluscous fauna is the absence of the larger species of *Helix* (*H. pomatia*, *H. nemoralis*, *H. arbustorum*, *H. hortensis*, &c.), whilst they are frequent in other parts of the boreal region—to which the Moscow molluscous fauna belongs too—nearer to the sea. As to the southernlimits of the boreal region in Russia, it is difficult to determine it, but M. Milachevitch supposes it to follow a line drawn from Riga to Tamboff and Saratoff.

PERISTALTIC INTESTINAL MOVEMENTS.—The movements of the intestine have been recently studied by the graphic method, by Signori Mosso and Pelicani (*Reale Ist. Lomb.*), experimenting both on man and the dog. Among other results it appears that at every movement of respiration there occur strong contractions of the rectum. Emotions and cerebral activity have a very manifest influence on the muscular fibres of the intestine, causing strong contraction. Besides so-called spontaneous undulations in the tracings, the direct cause of which is not known, it is possible, the authors prove, to contract at will portions of the intestine that are a considerable distance from the sphimeter muscle. The authors study the influence of changes of temperature on the tonicity of the intestinal walls, indicate the variations of the latter in sleep, digestion, and under influence of medicaments, &c., and show how intestinal movements are related to changes of volume in the forearm and blood-pressure in the carotid.

ON THE OCCURRENCE OF ROOT-FLORETS IN CATANANCHE LUTEA.—A paper on this subject by B. Daydon Jackson, Sec. L.S., was read before the Linnean Society on May 4.—M. J. A. Battandier, in writing to Sir John Lubbock, pointed out the occurrence of certain large single florets produced directly from the roots of this yellow-flowered composite. Examination of the large series of specimens of this species contained in the herbaria at Kew and the British Museum, showed that these

florets were to be found in almost every instance, frequently in great numbers, but usually overlooked from their great resemblance to scales of the root-stock. M. Battandier further stated that the fruit was twice the size of those contained in the normal capitula; also that the root-florets were not cleistogamic, a fact confirmed by finding specimens showing the anther-tubes and stigmata projecting. Similar instances were also recorded as occurring in two species of Scuipus and a Myosotis.

CHEMICAL NOTES

THE formulæ deduced by Guldberg and Waage in their general theory of action of mass have been recently applied, with satisfactory results, by R. Warder (*Amer. Chem. Journ.* iii. No. 5) to the case of saponification of ethylic acetate. W. Ostwald continues his work in the same field; he has recently studied the actions which occur when certain pairs of salts are fused together in equivalent quantities. His general result is that those salts which have the greatest heats of formation are always produced in greatest quantity. Berthelot's so-called "law of maximum work," viz. that of several possible products of a reaction that salt, in the formation of which most heat is evolved, is alone produced, is regarded by Ostwald as erroneous; if it were true, chemical equilibrium would be established only in those exceptional reactions wherein some of the reacting bodies underwent dissociation. Berthelot's statement is a return to the old hard and fast ideas on which "tables of affinity" were constructed, ideas long ago overthrown by C. L. Berthollet (*Journ. Pract. Chem.* xxv. 1).

DATA continue to be accumulated showing more definitely that there exists a close connection between the structure of molecules and the physical properties of the substances composed of these molecules. Pawlewski has recently published a short account of his researches on the "critical temperatures" of liquid compounds: he states that the critical temperatures of isomeric ethers are identical or very nearly so, that isomers containing "doubly linked" carbon atoms have a higher critical temperature than those in the molecule of which the carbon atoms are singly linked, &c. (*Berichte*, xv. 460).

IN an important paper bearing on the same general subject, E. Wilson states, as a result of his collation of many determinations of specific gravities of solids, that it is not justifiable to assign, as is usually done, a certain definite volume to each elementary atom in a compound molecule, but that the volume to be assigned to each atom in a compound molecule depends on the nature of all the atoms in the molecule (*Proc. R. S.*, 32, 457).

IN continuance of his experiments on the effects of pressure on chemical changes—before referred to in these notes, Spring states that he has prepared Wood's alloy (melting at 65°) by compressing, at 7500 atmospheres, iron filings, with bismuth, cadmium, and tin, in proper proportions. He has also obtained Rose's alloy (lead, bismuth, and tin), and also brass, by pressure of the constituent metals (*Berichte*, 15, 595).

AS the results of an extended series of observations on the structure of metals, Kalischer (*Berichte*, 15, 702) concludes that most of the metals are naturally crystalline, and that when the crystalline structure has been lost by mechanical treatment it can, in most cases, be restored by the action of heat.

PHYSICAL NOTES

AN important contribution to physico-mechanical science has been made by M. Berthelot in a memoir communicated to the Académie des Sciences of Paris, upon the rapidity of propagation of a wave of explosion. An explosion in a gaseous compound propagates itself, it would appear far more rapidly than a sound wave could travel in the medium. For example, the velocity of sound in mixed oxygen and hydrogen gases is 514 metres per second, while the explosion propagates itself at 2814 metres per second. M. Berthelot concludes that the wave is therefore not an acoustic wave at all, but a wave of chemical action. The characteristics of this new mode of propagation appear to be the following: uniform velocity of propagation (through tubes); independence of this velocity of the material of the tubes; tubes of lead and gutta-percha of equal calibre conveying the explosion at equal rates. The velocity in a capillary tube is slightly less than in a wide one, being 2390 metres per second for oxyhydric gas as against 2840 metres. The velocity differs in different mixtures, being 1080 metres per second in a mixture of oxygen and carbonic oxide. The velocity is independent of pressure which, in the experiments varied from 1 to 3 atmospheres. M. Berthelot attempts to identify this velocity with that of the translation of the gaseous molecules at the temperature attained in the explosion, as calculated from the formula of Clausius—

$$v = 29{\cdot}354 \sqrt{\frac{T}{\rho}} \text{ (metres per second)};$$

where T is the absolute temperature and ρ the density at 0° of the gas relatively to the air. He *assumes* T as 3000° in each case, which would give for the oxyhydric mixture a velocity of 2000 to 2500 metres per second and 1300 for carbonic acid. M. Berthelot therefore propounds the following view as to the way in which explosive action is propagated. In the film of gas first kindled a certain number of molecules are urged forward with a velocity corresponding to the maximum temperature of the chemical combination. Their shock against the neighbouring films determines there the commencement of chemical action, and so the movement proceeds, a uniform rate being observed except for those molecules which are close to the walls of the tube which give up in the form of heat a portion of their kinetic energy to the solid matter of the tube. A comparison with certain properties of sound waves leads one to doubt the finality of Berthelot's conclusion that these waves are not sound waves; for Regnault formed a similar retardation of sound-waves in narrow tubes, and it is known that their velocity is independent of pressure, and that it increases with an increase of temperature, and that the temperature which determines the velocity is not the temperature of the mass as a whole but the temperature of the molecules in the actual wave for the time being. The recent experiments of Galloway and of Abel on the propagation of an explosion in air charged with dust and contaminated with gas appear to deal with quite another phenomenon, namely, the velocity of spread of combustion in a space containing particles of solid matter floating in the air, and which has no more direct relation to the velocity of sound than has the velocity with which combustion is propagated along a train of gunpowder or a piece of slow-match.

ANOTHER contribution to experimental acoustics we owe to Mr. John Le Conte of California, who has published in the *American Journal of Science* some observations on sound-shadows in water. More than fifty years ago, when Colladon and Sturm were measuring the velocity of sound in the waters of the Lake of Geneva, Colladon remarked on the extreme sharpness with which an acoustic shadow was cast by a projecting wall that ran out into the lake. The greater sharpness of shadows might be expected from the mathematical theory of undulations, for waves of higher pitch than for those of lower, as the wave-lengths of the former are shorter, and therefore less liable to diffraction at the edges of acoustically opaque objects. Mr. Le Conte's experiments were almost all made with the waves produced by the explosion of cartridges of nitroglycerine, each containing 15 lbs. of the explosive stuff. These cartridges were being used in blasting a shallow reef in the harbour of San Francisco, and the means taken to observe the propagation of the shock consisted in sinking soda-water bottles and glass tubes filled with air, so as to be wholly or partially concealed behind solid objects such as wooden piles. A cartridge was exploded about 40 feet away from a pile about 12 inches in thickness; behind this obstacle, and for a distance of 12 feet behind it, a sharply-defined sound-shadow could be traced. Another instance is given in the singular preservation of buildings on the occurrence of an explosion at San Francisco when situated within the geometrical shadow of other buildings. Mr. Le Conte seeks to explain the relative sharpness of shadows of explosive sounds by supposing that in this case the very short impulse gives rise to a disturbance whose wave-length is exceedingly short. In connection with the subject, it may be worth while to recall Lord Rayleigh's beautiful experiment on the sound-shadow behind an opaque circular disk, where (as in the case of light for which, as predicted by Poisson and verified by Arago, there is a luminous point at the centre of the shadow), at the centre of the acoustic shadow, a perceptible augmentation of the shrill note of a bird-whistle was observed.

THE old device of exploring the vibrating column of air in an organ-pipe to ascertain the position of nodes and loops, by letting down into it a membrane of tissue paper on a wire frame, is